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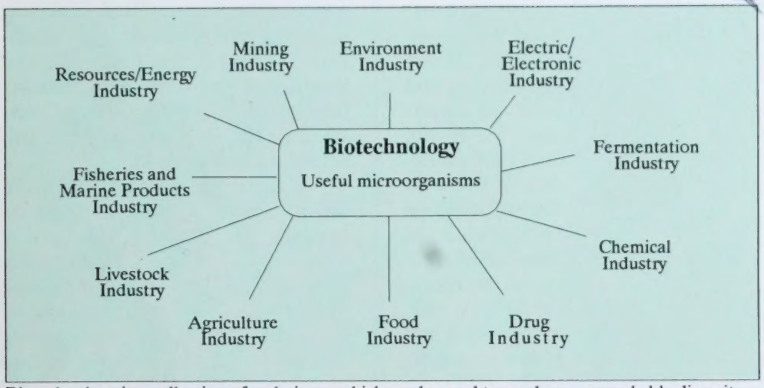

Biotechnology is a collection of techniques which can be used to produce a remarkable diversity of products in a variety of industries. Although Alberta's biotech sector is small, it produces a wide range of products and it is growing; the mood of business is optimistic.

Biotech Future Growing in Alberta

Products that prevent spoilage in silage and hay, experimental AIDS drugs used in research, advanced embryo transplantation techniques for dairy cattle breeding, a test for pancreatic cancer – all have something in common – they were developed using biotechnology.

Although the biotechnology business in Alberta is barely a decade old, these are just some of its products already on international markets.

At the heart of biotechnology is the alteration of the genetic material of organisms, microbes, plants and animals, to produce everything from drugs and hormones to modified plants and industrial chemicals. The remarkable diversity of products stems from the fact that biotechnology is really a collection of techniques. Biotechnology companies do not sell biotechnology, but rather products made using this technology.

"We look on biotechnology as an assortment of tools to enhance the development of new products. If one of the tools doesn't work, we drop it and look for alternatives. Our emphasis is on producing proprietary products," says Gordon Wells, President of Calgary-based **Biotechnica Canada Inc.**

Biotechnology is a relatively new field – the first successful gene transfer took place in the early 1970s. Most of Alberta's biotechnology companies were formed after 1985; only one predates the '80s. Total employment is about 250 and aggregate sector revenues are estimated to be $20 million annually.

Businesses tend to concentrate on two primary markets – human and animal health care – and sell their products worldwide. One of Alberta's leading biotechnology companies (specializing in bovine embryo manipulation), Calgary-based **Alta Genetics Inc.**, is aggressively pursuing international markets and recently negotiated a contract with China.

Although small, the provincial biotechnology sector is growing and the mood of business is optimistic.

"Biotechnology in Alberta is very young but things are changing, they're moving. We're going to make mistakes but we will develop into a centre for biotechnology," says Dr. Gerard Tertzakian, president of **Terrochem Laboratories Ltd.**, an Edmonton chemical company using biotechnology to develop experimental AIDS drugs.

Echoing Dr. Tertzakian's sentiment is Dr. Aladar Szalay, a world leader in recombinant DNA technology, one of biotechnology's most powerful tools. Recruited to Alberta in 1987 from the Boyce Thompson Institute at Cornell University, he occupies the University of Alberta's

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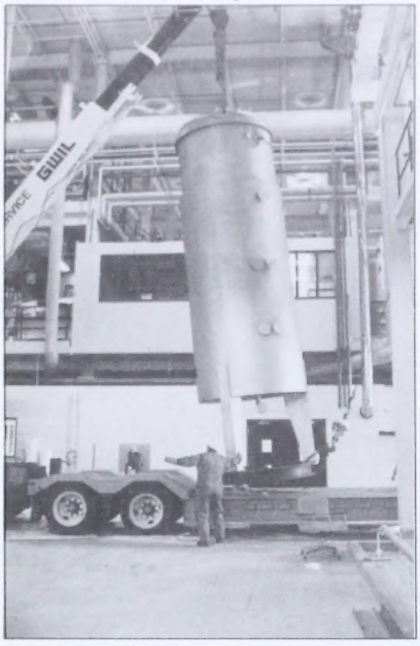
Research Council Anchors Biotechnology Web

A close look at Alberta's biotechnology sector reveals a web of interactions among universities, businesses and government. One of the key "anchors" of this web is the **Alberta Research Council.**

The Alberta Research Council has its own biotechnology department and operates a biotechnology pilot plant for companies seeking product development. Now in its second year of operation, the pilot plant has attracted national and international attention, and is considered one of the finest facilities of its type in North America.

A scale-up facility is an invaluable resource for the provincial biotechnology industry. The Research Council's pilot plant provides a bridge between fundamental research and commercialization – a necessary step for every company no matter the size. Although a laboratory-scale process may show great promise, there's no guarantee it will produce large enough quantities to make the process commercially viable.



A 15,000 litre fermentation vessel will soon be installed at the Alberta Research Council's biotechnology pilot plant bringing the plant's total capacity up to more than 25,000 litres.

"It can cost a company $10 million (Canadian) just to see if a process works on a pilot scale. Then they must essentially throw that $10 million away and build a full scale plant," says Dr. David Cox, the Council's Head of Biotechnology.

"The Research Council offers an alternative to this massive investment by providing the pilot scale facility and scale-up expertise. We're the only organization I know of that will do these things without demanding equity in the company. Instead, we ask for a tangible commitment to Alberta."

This policy has already had results. Scale-up studies on the production of nematodes (very small insect-killing organisms) for **Biosys Inc.**, a California biological pest control company, have lead to precommerical production in the toll facility. Biosys is now planning to build its own commercial plant in Alberta. ¤

(cont. from page 1)

Research Chair in Plant Biotechnology.

Dr. Szalay says there are many advantages to working in Alberta, such as a well-trained technical workforce, strong government support, motivated researchers, and the absence of large multinationals which dominate the biotechnology industry in many countries. He describes the atmosphere in Alberta for biotechnology as "very, very positive. There is enormous scientific wealth here and the economic resources to put it to work. The government, through TRT, is playing a leading role in encouraging the industry. There is also a very effective mechanism for technology transfer through the Alberta Research Council. I've not seen anything like this elsewhere in the world."

Despite the praise, the biotechnology sector is not resting on its laurels. Dr. Robert Hodges, a University of Alberta Biochemistry Professor and President of **Synthetic Peptides Inc.**, says work continues on encouraging more interaction among disciplines at the universities and more communication among universities, industry, and government.

"The expertise is here, now we have to develop more ways and means to take advantage of it," Dr. Hodges says. "We're still having growing pains but there are signs the community is really coming together." ¤

For more information about Alberta's biotechnology industry, contact Morley Hamilton, Director, Medical and Biological Sciences, TRT, 12th Floor, Pacific Plaza, 10909 Jasper Avenue, Edmonton, Alberta T5J 3M8.

Women in Science – Student Summer Research Program

Women in Scholarship, Engineering, Science and Technology (WISEST) is out to change the fact that there are not many women in science and research fields. The Student Summer Research Program places high school students, entering Grade 12, in University of Alberta sciences and engineering research projects for six weeks during the summer.

By demonstrating that work in science and engineering can be rewarding and exciting, the program encourages young women to consider careers in these fields and plan their education accordingly.

Although the number of students accepted is small (14 to 26 each year), other female students will become more aware of career possibilities through contact with the summer students. ¤

Innovative Ideas Feed Biotech Sector

The biotechnology sector continues to feed on the innovative ideas, products and processes developed at universities. Alberta is no exception, the majority of biotechnology companies in the province have been spawned by university personnel who represent a new breed of scientific entrepreneur.

It all started with **Chembiomed Ltd.** (the oldest biotechnology enterprise in Alberta), a university spin-off company which has developed a line of blood diagnostic and purification products. Chembiomed was established by University of Alberta scientist Dr. Raymond Lemieux in 1977.

"Ray Lemieux set the ball in motion for biotechnology in Alberta," says Robert Armit, Director of the University of Alberta's Office of Research Services. "Not only did he have landmark scientific achievements, he showed what can be accomplished commercially."

Other researchers have followed in Lemieux's footsteps. Biotechnology companies **Biomira Inc., Sci Can Diagnostics Ltd., SynPhar Laboratories Inc.**, and **Synthetic Peptides Inc.** are all university spin-offs.

Given the depth of talent at Alberta's universities, it's not surprising that its researchers are developing novel products and processes with commercial potential, or that they are establishing a worldwide reputation in biotechnology. Over 125 academics are engaged in biotechnology research at the universities of Alberta and Calgary. Over the past two fiscal years university funding for this research was nearly $20 million, with only one-quarter coming from provincial sources.

Biotechnology researchers at both universities form a multidisciplinary group, drawing members from the faculties of medicine, engineering, pharmacy, agriculture and science. The wide range of research covers medical diagnostics and therapeutics, immunology, microbiology, protein engineering, plant and animal science, forest biology, environmental biotechnology and bioprocess engineering.

Much of this work can be characterized as fundamental or curiosity-driven research. But don't be fooled by the name; developments from this kind of research can be just as useful as those which come out of so-called "applied" research. Dr. Tom Wegmann, a University of Alberta immunology professor and one of the founding members of Sci Can Diagnostics, says there are many "nuggets of gold" to be found in university research.

A good example of one of these nuggets is a variation of a DNA fingerprinting technique developed by University of Calgary scientist Dr. David Hoar. The technique, which the university has licensed to Calgary's **VenTech Healthcare Corp. Inc.**, can be used in a variety of applications including paternity suits and missing persons.

"I didn't set out to find this probe, it wasn't deliberate. By following our noses we got to the technique," says Dr. Hoar. "Basic research can have commercial spin-offs, it's just very difficult to predict what they will be." ¤

Update

Bronze Winner – **Pelorus Navigation Systems Inc.** of Calgary took bronze in the Small Business category of the Canada Awards for Business Excellence sponsored by Industry, Science and Technology Canada. Pelorus won the award for its innovative approach to the development of aviation equipment. The company is presently working with the Alberta Research Council in a joint venture to develop a Microwave Landing System (MLS) airborne receiver (see *Techciting Alberta* Issue 4 Nov. 87). The MLS system is now replacing existing Instrument Landing Systems at Canadian airports.

A Winning Invention – **Myrias Research Corporation** of Edmonton has won a certificate of merit in the invention competition of the Canada Awards for Business Excellence. Myrias has developed a parallel processing computer (see Issue 3 Sept. 87).

No Cause For Alarm - **Westronic Systems Corp.**, a subsidiary of Westronic Inc. of Calgary, has established R&D, Marketing and Manufacturing Headquarters in Richardson, Texas, to tap into the U.S. telecommunications market for alarm surveillance and control remote terminals.

China Calling – **CSI Communications Systems Inc.** of Morinville, Alberta, has been awarded a three-year contract by the Chinese Ministry of Foreign Affairs to supply long-range communications systems. The systems will be installed in Chinese embassies throughout the world, allowing each embassy to communicate directly with the Ministry's head office in China. ¤

National Agricultural Biotechnology Initiative For Western Provinces

The federal government and the four western provinces could provide up to $50 million for the National Agricultural Biotechnology Initiative (NABI). NABI funds will be used to support proposals for the commercialization of agricultural biotechnology products.

Eligibility for assistance to the private sector in Western Canada depends on individual applicants making a significant contribution and their own provincial government matching funds from the Western Diversification Fund.

The initiative will be managed by the Department of Western Economic Diversification and NABI's Advisory Board. An office will be set up in Saskatoon to receive applications from individuals and businesses in the private sector across Western Canada.

Alberta representatives on the Advisory Board and Secretariat are Gordon Wells, **Biotechnica Canada**, Calgary; and Ralph Christian, **Alberta Agriculture**, Edmonton. ¤

Genetic Technology Research Can Lead to Better Crops

In the future, plants could have built-in protection against disease and insects. Farmers, foresters and gardeners won't need to spray plants with chemicals – which are costly and potentially harmful to the environment. Producers will get higher yields and better quality crops and trees. Dr. Aladar Szalay's research group is working to make this reality. His group is looking for ways to beneficially alter the genetic make-up of plants.

Dr. Szalay, a world-renowned molecular biologist, has the Research Chair in Plant Sciences at the University of Alberta. His researchers work at the University's Plant Biotechnology Centre, located at the Alberta Research Council's facilities in Edmonton.

Potentially, their research could find ways to derive increased amounts of a desired substance from one plant. For example, a plant producing a rare, expensive and medically-important substance in its flowers, in very small quantities, could be made to produce the substance not only in its flowers, but throughout.

Extracting large amounts of a desired substance from a relatively small amount of plants would make for cost-efficient, profitable operations. One possible result - Alberta farmers would produce high-value plants in greenhouses during the off-season winter months, selling them as raw materials to pharmaceutical companies. Alberta has what it takes to develop such an industry – lots of sunshine and abundant, low-cost energy.

The research might also eventually lead to genetic technology for designing crops that are nutritionally improved. Healthier foods in our diet would prevent disease. With rising health care costs, there is growing interest in preventive medicine.

There are great opportunities in Alberta for the production of value-added agricultural products, according to Dr. Szalay. One important reason is that producing these new products requires established expertise in standard farming practices, which Alberta certainly has.

Dr. Szalay came to the province in the spring of 1987. In February, 1988, his laboratories were moved and four of his people came from Cornell University, New York. Ten people are now working at the Centre; eventually this will grow to a staff of 25, composed of professors, postdoctoral fellows and graduate students.

"The reason I came here is the spirit in Alberta, which is a very creative, very forward-looking spirit," explains Dr. Szalay. "Most university labs in the U.S., Europe and Canada now realize their responsibility to society, in that the basic research they perform will generate new technologies essential to boosting the economy. Here in Alberta, the universities and the Government of Alberta are actively pursuing the commercialization of research discoveries."

Since Dr. Szalay came to Alberta, scientists from all over the world are applying to work here at the Plant Biotechnology Centre. Many are Canadians working abroad who wish to return.

"We need to create high-calibre intellectual centres for modern molecular genetics, agriculture and medicine here in Canada, in order to attract foreign 'brain-power' as well as to keep our scientists at home," he insists.

The key to modern biology today, according to Dr. Szalay, is an interdisciplinary approach. For example, part of his laboratories are moving into the Department of Cell Biology in the Medical Research Building on the U of A campus.

His group will consist of graduate students from agriculture, medicine and biological sciences. He explains, "Scientists in all these disciplines are using gene-transfer-based technologies for understanding the principles governing living organisms. We should not create islands, but work together." ¤

Alberta Achievement Awards Program

If you know of someone who spends long hours in community service, excels in the arts or sports, or has made an outstanding professional contribution, send in your recommendation for the **20th Annual Alberta Achievement Awards.**

The Awards cover three categories: Performance, Service, and Excellence. Performance awards are presented to Albertans who, as provincial representatives, placed first in a Canadian championship, or first, second or third in a recognized international championship, between November 15, 1987 and November 15, 1988. Both athletic and non-athletic competition winners may be eligible for a Performance award.

Service awards are given to those who have made exceptional voluntary contributions of national, provincial or regional significance, over a period of 10 years or more.

Excellence awards go to those who have made great contributions and/or achievements in a profession or occupation at provincial, national or international levels.

For further criteria guidelines and nomination forms contact Leslie Leibel at Alberta Culture and Multiculturalism, Achievement Awards Program, (403) 427-8665. Deadline for submissions is November 16, 1988. ¤

Microchip Technology Agreement

The **Alberta Microelectronic Centre** (AMC) and the federal Department of Communications has signed an agreement that will provide Alberta industry with access to state-of-the-art microchip technology.

The memorandum of understanding enables AMC to co-operate with the Department of Communications in the development of silicon-based, digital signal-processing components. The agreement provides for the conception, definition, design and testing of prototypes and circuits. AMC will be granted a royalty-free, non-exclusive licence to use circuit designs generated by the federal Communications Research Centre. ¤

Education First Step in Microelectronics Design Process

Encouraging clients to use other's services may not be normal business practice, but for the **Alberta Microelectronics Centre** (AMC), it fulfills the Centre's role of educating the client.

"AMC is not here to compete with private industry," says Tom Lambourne, Vice President, Market Development, at AMC's design facility in Calgary. "We are here to educate...to inform companies of the available technologies so they can understand the benefits of microelectronics."

Once a company has used AMC's facilities and services to design and produce an Application Specific Integrated Circuit (ASIC), the Centre will steer the company to others in industry.

"We will help them with the first design, so they see the advantages and transfer the knowledge in-house. Then we encourage the company to look to industry for the next project," explained Mr. Lambourne.

It can take six to 14 months before a company commits to an ASIC design. This may seem to be a lengthy process, but companies usually are not looking at chip technology when AMC first talks to them. It is not until later when they realize they can use the technology.

AMC design staff work with client staff to assist in each step of the ASIC design process.

A company has three options once it decides to use AMC's services:

Turnkey Design – the entire ASIC design is done by AMC.

Joint Design – the company and AMC work together.

Client Design – AMC will rent workstations and software and train the client's staff to do the design themselves.

AMC prefers joint or client design because it fosters the transfer of the technology used in the design.

The Centre has nine Sun-3 workstations in Calgary and three in Edmonton. Some of the software available for company use will allow the designer to enter the schematic and simulate the circuit operation so modifications can be made without the lengthy breadboarding exercise. The software is a valuable tool which can shorten delivery times – right from design to production – and reduces expensive prototyping work.

Two Alberta companies that have recently used AMC services are **Lee Tools** of Red Deer and **Simply Software** in Calgary. Lee Tools designed an ASIC for use in a downhole well instrument and Simply Software developed an ASIC for a laser printer font cartridge.

For more information about AMC services, contact: Tom Lambourne at (403) 289-2043 or Fax (403) 289-2047. ¤

Emerging Technologies Position Group For Future Success

Imagine a device, the size of a hand-held tape recorder, attached to your bicycle which could pinpoint your location within 50 metres.

Sound farfetched? Not really, if you consider the advancements in navigational systems and electronic map displays.

Automatic Vehicle Location (AVL) will be possible due to new and emerging technology developments.

"The commercial benefits and possibilities are fantastic", says Dr. Gérard Lachapelle, Professor of Survey Engineering at the University of Calgary. "A unit costing $500 could be put in taxis or moving vans. A taxi could be dispatched to a fare with information as to the best route to pick up a customer."

While AVL is still in the future, **The University of Calgary Surveying Group** is presently working towards developing software products which combine two fairly new technologies – Global Positioning Systems (GPS) and Inertial Systems (INS).

GPS is a satellite-based positioning system that relies on the propagation of electromagnetic waves to measure distances from a satellite to a user equipped with a receiver. Since the satellite's position is known, it allows distances to be calculated.

INS relies on the laws of Newton and the rotation of the earth to measure displacement and orientation in an absolute reference system.

The two systems complement each other and are easily integrated. The strength of each system is the weakness of the other which means GPS/INS is greatly reliable and accurate.

The Group's software products will assist the private sector, especially oil and gas companies, who require surveying services. The software will be used for marine and ocean related activities, such as the Hibernia oil fields which will demand the precise positioning of oil platforms. It will also have applications for land, ship-borne and airborne positioning and navigation.

The University of Calgary decided to get involved in this area due to the expected commercial success and the collective experience within the Department of Survey Engineering. People like Dr. Klaus Peter Schwarz who has been at the forefront of inertial technology for the past three years, and Dr. Ed Krakiwsky, head of the Department, who has thorough knowledge of

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E.J. (Jack) Cuyler (centre), Chairman of the Edmonton Research Park, receives a plaque commemorating the opening of the Advanced Technology Centre in Edmonton fom Les Young, (left) Minister TRT and Edmonton Mayor, Lawrence Decore. Construction of the Centre was funded by the Alberta Government and the City of Edmonton. It houses a number of small, new high-tech businesses in early stages of development.

Bridging the Gap – Science and the Media Conference

Over 150 scientists, journalists, science writers and public relations practioners recently gathered at The University of Calgary, Alberta, to discuss common concerns about improving efforts at increasing public awareness of science.

"Bridging the Gap, Science and the Media" gave journalists and scientists the opportunity to discuss current problems and potential solutions in providing and reporting information. It promoted discussion of the process of science literacy and the role played by scientists and media in this process. The conference also presented story opportunities for science writers and provided training sessions for scientists to improve their ability to write for lay audiences and to learn how to do more effective interviews for broadcast media.

The issue of reporting science is complicated by the fact that media can't be lumped together. Each has its own limitations in reporting science, in particular television and radio where items must be short and to the point. Short articles and electronic media items sometimes drown out the larger story by keying on a single point, or as one panelist described it, "the sexy part of the story."

Reporting science is also difficult due to its technical vocabulary and the scientist's inclination to give long and cautious statements. Scientists need to be able to explain the subject briefly and clearly.

Scientists believe reporters should have a basic understanding of science and show greater interest in the stories they are preparing. Scientists would also like to have editorial control. Most reporters don't think this is reasonable since they work on tight deadlines.

The Graduate Program in Communications Studies, organizers of the conference, received positive feedback from most participants. Major suggestions coming from the conference include; scientific societies stepping up efforts to educate scientists to popularize science awareness; and science writers holding writing seminars and workshops to promote a better understanding of science activities. ¤

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satellite positioning and navigational systems. Dr. Lachapelle rounds out the group with eight years of industrial research and operational experience in positioning and navigational systems.

Calgary is an oil and gas centre and the Surveying Group has been successful in providing services to this industry. As a direct benefit, many graduating students have found employment with Calgary surveying companies.

While the main interests of the group are resources-based, the Surveying Group also works with many emerging high-tech companies in specilized areas outside the oilfields. ¤

Tech-bits

University/Industry Cooperation – An affiliation agreement has been signed between **The University of Calgary** and the **Alberta Telecommunications Research Centre** (ATRC). The affiliation will add a new teaching position to the Department of Electrical Engineering through a professorship funded by ATRC. An existing faculty member will be designated an adjunct or affiliate professor to work on research of interest to ATRC. ATRC will assist the university in attracting additional graduate students by providing scholarships and fellowships for up to two graduate students. ATRC is funded by six industrial sponsors – **Bell-Northern Research Ltd., Alberta Government Telephones, Edmonton Telephones, LSI Logic Corporation of Canada, NovAtel Communications Ltd.** and the **Department of Technology, Research and Telecommunications,** Alberta Government.

Phone Power – Companies in Calgary and southern Alberta can now reach out and touch someone at the **Alberta LASER Institute** directly by calling a "remote call forwarding" phone number in Calgary. Calls placed to 236-9242 are automatically forwarded to the Institute in Edmonton. ¤

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